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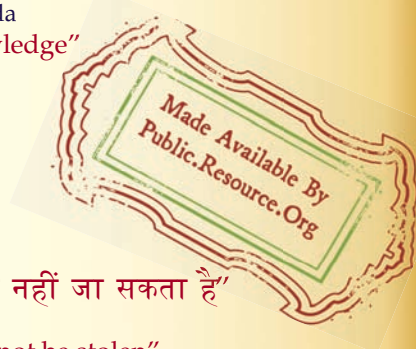
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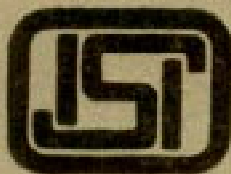
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GLOSSARY OF
SHIPS' HYDRODYNAMIC TERMS
PART III RESISTANCE AND PROPULSION

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GLOSSARY OF SHIPS' HYDRODYNAMIC TERMS

PART III RESISTANCE AND PROPULSION

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 27 October 1976, after the draft finalized by the Shipbuilding Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 The object of this standard is to specify the technical and scientific terms used in ship geometry, hydrostatic and hydrodynamic terms and to facilitate the exchange of information, particularly at international level, and the ease of understanding as regards to documents relating to naval architecture.

0.3 The terms are represented by symbols which have been arranged in alphabetical order for ease of interpretation.

0.4 No rules are laid down as to whether subscripts are to be shown by capital or lower case letters, although the letters shown in this standard are in the preferred style.

0.5 When required, the suffixes M and S should be introduced to distinguish between quantities referring to model and ship respectively.

0.6 This standard is being issued in six parts. The other parts in the series are:

Part I Basic quantities

Part II Ship geometry

Part IV Sea keeping

Part V Manoeuvrability

Part VI Strength and vibration

0.7 While preparing this standard, current work by ISO/TC 8 on 'Terminology of profiles and hydrodynamic terms' and International Towing Tank Conference (ITTC) has also been considered.

1. SCOPE

1.1 This standard (Part III) deals with terms related to ships' resistance and propulsion.

2. TERMINOLOGY

SL No.	SYMBOL	TERM	DEFINITION	SYMBOL OF SI UNIT
2.1	a	Resistance augment fraction	$\frac{T - R_T}{R_T}$	—
2.2	B _n	Boussinesq-number	$\frac{U}{\sqrt{g R_H}}$	—
2.3	B _p	Taylor's propeller coefficient based on delivered horsepower	$n P_D^{1/2} / V_A^{2\frac{1}{2}}$ where n is in rev/min, P _D in horsepower; V _A in knots	—
2.4	B _T	Taylor's propeller coefficient based on thrust horsepower	$n P_T^{1/2} / V_A^{2\frac{1}{2}}$ where n is in rev/min, P _T in horsepower; V _A in knots	—
2.5	C _A	Incremental resistance coefficient for model-ship correlation	$\frac{R_A}{\frac{1}{2} \rho V^2 S}$	—
2.6	C _{AA}	Air or wind resistance coefficient	$\frac{R_{AA}}{\frac{1}{2} \rho V_R^2 A_v}$	—
2.7	C _D	Drag coefficient	$\frac{D}{\frac{1}{2} \rho A V^2}$	—
2.8	C _F	Specific frictional resistance or drag coefficient	$\frac{R_F}{\frac{1}{2} \rho S V^2}$	—
2.9	C _{FO}	Frictional resistance coefficient in two dimensional flow	$\frac{R_{FO}}{\frac{1}{2} \rho S V^2}$	—
2.10	C _L	Lift coefficient	$\frac{L}{\frac{1}{2} \rho A V^2}$	—
2.11	C _P	Power loading coefficient	$\frac{P_D}{\frac{1}{2} \rho V_A^3 \frac{\pi D^2}{4}}$	—
2.12	C _{PV}	Specific pressure resistance coefficient (of viscous origin)	$\frac{R_{PV}}{\frac{1}{2} \rho S V^2}$	—
2.13	C _R	Specific residuary resistance coefficient	$\frac{R_R}{\frac{1}{2} \rho S V^2}$	—
2.14	C _T	Specific total resistance coefficient	$\frac{R_T}{\frac{1}{2} \rho S V^2}$	—
2.15	C _{Th}	Thrust loading coefficient	$\frac{T}{\frac{1}{2} \rho V_A^2 \left(\frac{\pi D^2}{4} \right)}$	—
2.16	C _{TL}	Telfer's resistance coefficient	$\frac{g R_T L}{\Delta V^2}$	—
2.17	C _{TQ}	Qualified resistance coefficient	$\frac{C_T \nabla}{\eta_R \eta_B}$	—

SL No.	SYMBOL	TERM	DEFINITION	SYMBOL OF SI UNIT
2.18	$C_{T\triangledown}$	Resistance — displacement coefficient	$\frac{R_T}{\frac{1}{2} \rho V^2 \triangledown^{\frac{2}{3}}}$	—
2.19	C_v	Specific total viscous resistance coefficient	$\frac{R_v}{\frac{1}{2} \rho S V^2}$	—
2.20	C_w	Specific wave-making resistance coefficient	$\frac{R_w}{\frac{1}{2} \rho S V^2}$	—
2.21	$\textcircled{C}$	R. E. Froude's resistance coefficient	$\frac{1\,000\,R_T}{\Delta \textcircled{K}^2}$	—
2.22	D	Drag (a force)	Force in the direction of motion generally for a completely immersed body	N
2.23	F_D	Towing force in a self-propulsion test	Applied to model in propulsion test carried out at the ship propulsion point	N
2.24	F_n	Froude number	$\frac{V}{\sqrt{gL}}$	—
2.25	F_{nh}	Froude depth number	$\frac{V}{\sqrt{gh}}$	—
2.26	$F_{n\triangledown}$	Speed — displacement coefficient	$\frac{V}{\sqrt{g\triangledown^{\frac{1}{3}}}}$	—
2.27	$\textcircled{F}$	R. E. Froude's frictional resistance coefficient	$\frac{1\,000\,R_F}{\Delta \textcircled{K}^2}$	—
2.28	J	Advance coefficient or advance number of propeller	$\frac{V_A}{nD}$	—
2.29	J_v	Apparent or ship speed advance coefficient	$\frac{V}{nD}$	—
2.30	k	Three dimensional form factor on flat plate friction	$\frac{C_v - C_{Fo}}{C_{Fo}}$	—
2.31	k_1	Correlation factor for propulsive efficiency for ship and model	$\frac{\eta_{DS}}{\eta_{DM}}$	—
2.32	k_2	Correlation factor for propeller rate of revolutions for ship and model	$\frac{n_s}{n_M}$	—
2.33	K_Q	Torque coefficient	$\frac{Q}{\rho n^2 D^5}$	—
2.34	K_R	Resistance coefficient corresponding to K_Q and K_T	$-\frac{R_T}{\rho n^2 D^4}$	—

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SL No.	SYMBOL	TERM	DEFINITION	SYMBOL OF SI UNIT
2.35	K_T	Thrust coefficient	$\frac{T}{\rho n^2 D^4}$	—
2.36	$\textcircled{K}$	R. E. Froude's speed displacement coefficient	$\sqrt{\frac{4\pi}{g}} \cdot \frac{V}{\nabla^{\frac{1}{3}}}$	—
2.37	L	Lift (a force)	Force in a direction perpendicular to motion	N
2.38	$\textcircled{L}$	R. E. Froude's speed-length coefficient	$\sqrt{\frac{V}{gL}} \cdot \frac{1}{4\pi}$	—
2.39	n	Rate of revolution	—	s ⁻¹
2.40	P_B	Brake power	—	W
2.41	P_D	Delivered power at propeller	$2\pi Qn$	W
2.42	P_E	Effective power	$R_T V$	W
2.43	P_I	Indicated power	Determined from mean pressure on piston	W
2.44	P_S	Shaft power	P_D plus the losses along the shafting	W
2.45	P_T	Thrust power	$T V_A$	W
2.46	Q	Torque	Corresponding to delivered power P_D	Nm
2.47	r	Three dimensional form factor on flat plate friction	$\frac{C_v}{C_{v0}} = 1+k$	—
2.48	R	Resistance in general	Force opposing motion	N
2.49	R_n	Reynolds number	For ship VL/ν , for propellers Uc/ν , where U and c refer to the fluid and to the section at 0.7 R	—
2.50	R_A	Model-ship correlation allowance	Additional resistance to be added to the smooth ship prediction to complete the model-ship	N
2.51	R_{AA}	Air or wind resistance	—	N
2.52	R_{AP}	Appendage resistance	—	N
2.53	R_{AR}	Roughness resistance	—	N
2.54	R_F	Frictional resistance	Due to fluid friction on a surface	N
2.55	R_{FO}	Frictional resistance in a two dimensional flow	—	N
2.56	R_{PV}	Pressure resistance of viscous origin	Pressure resistance due to viscosity	N

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SL No.	SYMBOL	TERM	DEFINITION	SYMBOL OF SI UNIT
2.76	w_Q	Taylor wake fraction determined from torque identity	Speed V_A determined by a comparison between an open-water propeller test and a self-propulsion test, Q and n having the same values in both tests	—
2.77	w_T	Taylor wake fraction determined from thrust identity	Speed V_A determined by a comparison between an open-water propeller test and a self-propulsion test, T and n having the same values in both tests	—
2.78	W_n	Weber number	$\frac{U^2 \cdot L}{K}$; U and L relate to the fluid and specified section	—
2.79	x	Load fraction	In power prediction load factor $(1 + x)$ given by $(1 + x) P_E = \eta D P_D$	—
2.80	α	Specific air content of water	Mass of air contained in water per unit of volume	$\text{kg} \cdot \text{m}^{-3}$
2.81	α_s	Saturated air content of water	Mass of air contained in water per unit of volume at saturation point	$\text{kg} \cdot \text{m}^{-3}$
2.82	β	Appendage scale effect factor	Ship appendage resistance/ model appendage resistance	—
2.83	β	Advance angle of a propeller blade section	$\beta = \arctg \left(\frac{V_A}{2\pi R \eta} \right)$	—
2.84	β_i	Hydrodynamic flow angle of a propeller blade section	Flow angle taking into account induced velocity	—
2.85	γ_R	Wind direction, relative	—	—
2.86	δ	Taylor's advance coefficient	nD/V_A where n is in rev/min, D in feet, V_A in knots	—
2.87	Δ	Displacement weight	$\nabla \cdot w$	N
2.88	∇	Displacement volume	—	m^3
2.89	η	Efficiency in general	—	—
2.90	η_B	Propeller efficiency behind ship	$P_T/P'_A = TV_A/2 \pi Q n$ P_T, V_A, Q, n measured in propulsion test	—

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SL No.	SYMBOL	TERM	DEFINITION	SYMBOL OF SI UNIT
2.91	η_D	Propulsive efficiency or quasi propulsive coefficient	$\frac{P_E}{P_D}$	—
2.92	η_G	Gearing efficiency	—	—
2.93	η_H	Hull efficiency	$\frac{1-t}{1-w}$	—
2.94	η_I	Ideal propeller efficiency	Efficiency in non-viscous fluid	—
2.95	η_M	Mechanical efficiency	$\frac{P_s}{P_1}$ or $\frac{P_B}{P_1}$	—
2.96	η_O	Propeller efficiency in open water	$P_T/P_D = TV_A/2 \pi Q n$. T, V_A , Q, n measured in an open-water test	—
2.97	η_R	Relative rotative efficiency	$\frac{\eta_R}{\eta_O}$	—
2.98	η_s	Shafting efficiency	$\frac{P_D}{P_3}$	—
2.99	η_T	Thermal efficiency	—	—
2.100	λ	Advance ratio of a propeller	$\frac{V_A}{\pi n D}$	—
2.101	σ	Cavitation number based on a vapour pressure	$\frac{(p - p_v)}{q}$	—
2.102	σ_c	Cavitation number based on actual cavity pressure	$\frac{(p - p_c)}{q}$	—

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ON

SHIPS' HYDRODYNAMIC TERMS

IS :

8214 (Part I)-1976 Glossary of ships' hydrodynamic terms: Part I Basic quantities

8214 (Part II)-1976 Glossary of ships' hydrodynamic terms: Part II Ship geometry

8214 (Part IV)-1976 Glossary of ships' hydrodynamic terms: Part IV Sea keeping

8214 (Part V)-1976 Glossary of ships' hydrodynamic terms: Part V Manoeuvrability

8214 (Part VI)-1976 Glossary of ships' hydrodynamic terms: Part VI Strength and vibration

8215-1976 Glossary of ships' propellers

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Conversion</i>
Force	newton	N	1 N = 1 kg. 1 m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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